meter as compared with the open-bar disc photometer for general gas-testing work.

Several chapters are devoted to the minutiæ of photometric work, whilst in chapter ix. the measurement of illumination is dealt with, and another chapter describes the practical application of the methods employed, the work concluding with a valuable review of the subject of dioptric distribution of light.

The whole work is excellent from all points of view, and will form an addition to the engineer's and architect's library of far more than ordinary value.

MODERN GEOGRAPHY.

(1) *The Nations of the Modern World: an Elementary Study in Geography.* By H. J. Mackinder. Pp. xvi+319. (London: G. Philip and Son, Ltd.; Liverpool: Philip, Son, and Nephew, Ltd., n.d.) Price 2*s.*

(2) *A Geography of Ireland.* By O. J. R. Howarth. Pp. 224. (Oxford: Clarendon Press, 1911.) Price 2*s.* 6*d.*

(3) *Aberdeenshire.* By A. Mackie. Pp. x+198.

(4) *Huntingdonshire.* By the Rev. W. M. Noble. Pp. ix+152.

(5) *Worcestershire.* By L. J. Wills. Pp. ix+154. (Cambridge: University Press, 1911.) Price 1*s.* 6*d.* each.

(1) THE first of these works must not be regarded merely as a reading book for schools. It is, as its author observes, "a book of mingled geography and history," and contains so much matter that it was surely worthy of an index. While it develops the theme of three previous works, and brings out the bearing on human relations of the geographical conditions there described, it forms at the same time an independent treatise, which will stimulate the memory of many readers of full age. It is these, indeed, who will enjoy it thoroughly. A knowledge of modern history, and much of it obtained at first hand, is necessary for the complete appreciation of the changes of the map of Europe. Mr. Mackinder brings the older stages, such as those accompanying the Seven Years' War and the Napoleonic epoch, tersely and vividly before us. The later steps, the freeing of Venice, the partition of Lorraine, the uplifting of Bosnia, belong to our own eventful times. But we are led also to trace the rise of the United States and of Japan, and to take a large and scientific view of the inevitable expansion of Germany (p. 250), where men almost of our own blood are looking out also on the world. It may be somewhat ironic to suppose (p. 257) that the immense progress of Egypt under British organisation incited the Turks to improve their own home government; but the author's treatment of the British Empire as a whole forces a sense of responsibility upon the most insular and reluctant conscience. We may not like the reference nowadays (p. 258) to Japan and Turkey as "two heathen Powers," a phrase that has slipped in somehow from Mr. Mackinder's studies of the early nineteenth century; but his outlook is elsewhere that of the philosophic traveller. Under his direct and closely written sentences, we trace always that fine feeling for duty which is man's highest possession on this strange rotating globe.

(2) Mr. Howarth's "Ireland" is a welcome addition to the Oxford Geographies, a series edited by Prof. Herbertson. Aided by maps and excellent photographic illustrations, it brings the features of the country, grouped in natural regions, well before us. The author makes somewhat little (pp. 44 and 45) of Jukes's classic explanation of the courses of the southern Irish rivers, and seems to think that the Blackwater may have run against the face of an upraised fault-block at Cappoquin. Lamplugh's justly accepted explanation of the Scalp is neglected on p. 64, while the gorge of the Dargle is strangely described as having been deserted by its stream. Fig. 5, showing a drumlin-covered country backed by the Curlew Hills, is not so representative as it should be of "the Central Lowland," and the geological descriptions generally seem to date from the appearance of Hull's "Physical Geology and Geography of Ireland." We thus have Archæan granites (Fig. 3) opposed to large areas of "Cambrian and Silurian" strata in the metamorphosed regions; but the author himself must be held responsible for the insertion on his map of a Silurian district in the extreme south. Chapter xxvi. might be improved by an account of the cooperative organisation of agriculture, which has been largely aided by the fact that Ireland is a convenient and detached geographical unit. The publications of the Irish Department of Agriculture will assist Mr. Howarth in his next edition. The book has so many good points, and so clearly connects the structure of the country with the life of its inhabitants, that we hope it will meet with ready recognition.

(3) The county geographies issued by the Cambridge University Press, with their coloured physical and geological maps, and numerous landscape illustrations, have already taken a high rank. Aberdeenshire is largely a granite county, with solemn ice-worn highlands, and castles as stern as the jutting rocks along its coast. Mr. Mackie is a student of nature with a keen literary taste, and human interests and antiquities are evidently as attractive to him as are the birch-woods and the moors.

(4) The Rev. W. M. Noble's "Huntingdonshire" in the same series presents a very different country, where the fundamental rocks rarely appear from beneath the covering of glacial detritus and alluvial fenland. Too little emphasis seems to be laid (p. 31) on the high interest of the boulder-clay. The agricultural features, the great manor houses, and the stone bridges along the grand old highways are excellently illustrated and described.

(5) In "Worcestershire," Mr. L. J. Wills has a fascinating field. He describes the high ridge of Archæan granite in the Malverns, which rise on the western border like a blue wave against the evening sky. He illustrates the British formations up to the oolites of Bredon, and then directs attention to the upland vegetation of the Lickey Hills and the relics of old forests in the lowlands. The frosts in the hollows of the fruit-growing districts (p. 45) are, we presume, due to the creep of cold air downwards on still nights,

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rather than to an increase in the amount of moisture present. A Severn coracle is figured (p. 87), and the antiquities lead us on to the stone houses of the Cotteswolds, and the unrivalled half-timber villages of the Trias plain. The chestnut-tree growing from a tomb in Kempsey Church (p. 140) may puzzle the reader who has not seen it. G. A. J. C.

MATHEMATICAL AND PHYSICAL CHEMISTRY.

(1) *Theoretical Chemistry from the Standpoint of Avogadro's Rule and Thermodynamics.* By Prof. W. Nernst. Revised in accordance with the sixth German edition by H. T. Tizard. (London: Macmillan and Co., Ltd., 1911.) Price 15*s*. net.

(2) *Higher Mathematics for Chemical Students.* By J. R. Partington. Pp. v+272. (London: Methuen and Co., Ltd., 1911.) Price 5*s*.

(3) *Abhandlungen der Deutschen Bunsen-Gesellschaft für angewandte physikalische Chemie.* Zweiter Band, Nr. v., Messungen elektromotorische Krafte galvanischer Ketten, mit wasserigen Elektrolyten. By R. Abegg, Fr. Auerbach, and R. Luther. Pp. x+213. (Halle a. S.: W. Knapp, 1911.) Price 8.40 marks.

(1) PROF. NERNST'S text-book occupies a special position amongst text-books of physical chemistry, written as it is by an author of such eminence as a pioneer and investigator in the science, and of such remarkable powers of exposition. From the chemical point of view no better basis for a work of the kind can be adopted than that of Avogadro's rule, for one of the main practical problems of the chemist is the determination of molecular concentrations. Gas densities, osmotic pressures, freezing and boiling points of solutions, conductivity of electrolytic solutions, and electromotive forces are all measured with this primary object in view, and therefore Avogadro's rule is at the root of them all. On this sound chemical basis, then, with the aid of the two laws of thermodynamics, the author has built. His ideas are always clear cut, his expression of them is always ordered and concise, and his mathematical proofs are of special neatness and brevity. It is no wonder, then, that although the book is scarcely intended for beginners, it should have reached a sixth edition in German and a third in English. The advanced student and teacher will specially welcome in this latest edition a detailed account of Prof. Nernst's new thermodynamical theorem, of which so much has been recently heard.

It is a matter for regret that the original English translation of Prof. Nernst's work was far from satisfactory, and so to a considerable extent spoiled the vogue of the book. The present translation has been revised and partly rewritten, and has without doubt been thereby vastly improved. But nothing short of complete retranslation could do justice to the original. However, an occasional awkwardly turned phrase of a distinctly Teutonic flavour will probably not greatly incommode the average reader, and so to all those who desire acquaintance with the facts and theories of physical chemistry and an indication of the lines of progress of the science, this translation of Prof. Nernst's excellent and unique work can be unreservedly recommended.

(2) Of all the mathematical books intended for the use of chemical students which have come under the notice of the present writer, Mr. Partington's is the most serviceable. The author has had a clear notion of the practical problem to be solved, and has performed his task successfully. He does not attempt to teach too much, and strictly adheres to what will be practically useful to the student of physical chemistry. Brief explanations of the nature of the mathematical processes employed are given, and their application is at once shown by well-selected examples. Thus convergent series are illustrated by the two examples of the washing of precipitates, and extraction from aqueous solution by means of ether; maxima and minima by the rate of catalysis of methyl acetate by water; the compound interest law by the decay of radio-activity; and so on. Alike to the chemical student who has no previous knowledge of the differential and integral calculus, and to the student who has learnt the methods of the calculus, but is at a loss how to apply them, this little book will be of considerable value.

(3) The Bunsen-Gesellschaft deserves the gratitude of those who work on the subject of electromotive force for the issue of the volume under review. It consists of three parts: (1) a complete systematic and chronological bibliography of measurements of electromotive forces; (2) a selection of the most trustworthy measurements reduced to a uniform system; and (3) tables of the most probable values of single electrode potentials.

In the bibliographical section the nature of the electromotive combinations measured is given, but not the numerical values obtained. Only aqueous solutions are considered, and such combinations as involve an agency external to the cell are excluded, *e.g.* thermoelectric and photoelectric combinations, decomposition potentials, and the like. The arrangement is by elements according to the groups of the periodic table, both in the bibliographical and in the tabular sections; the single potentials are referred to the normal hydrogen electrode as zero.

With this book of reference at hand the worker at electromotive force can ascertain in the minimum of time what trustworthy work has already been done in his special branch, and see at a glance the most probable numerical values for any electromotive combination in which he may be interested. J. W.

OUR BOOK SHELF.

Field Note-book of Geological Illustrations. Arranged by Hilda D. Sharpe; containing 86 photographs and maps. Pp. 51. (Manchester: Flatters and Garnett, Ltd., n.d.) Price 3*s*. net.

THE idea of this book is a very happy one. Miss Sharpe has collected a number of photographs illustrating geological features, mainly from places in the British Isles, and Messrs. Flatters and Garnett are prepared to supply lantern-slides of most of them at 1*s*. each, or on hire at 1*s*. 3*d*. a dozen. Even as a supplement to the fine series issued by the British

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